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July 25, 2017

Via ECFS and IBFS

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: **Written *Ex Parte* Presentation Regarding Certified Aviation Devices, IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SAT-MOD-20120928-00160; SAT-MOD-20120928-00161; SAT-MOD 20101118-00239; SES-MOD-20121001-00872**

Dear Ms. Dortch:

Garmin International, Inc. ("Garmin") hereby submits these comments regarding submissions filed by Ligado Networks LLC ("Ligado") on June 5 and 22, 2017, in the above-captioned dockets. Garmin is a leading, worldwide provider of navigation equipment, committed to making superior products for automotive, aviation, marine, outdoor, and sports uses that are an essential part of its customers' lives. Garmin has a long history of innovation and of working with the Federal Communications Commission ("FCC" or "Commission"), other agencies, and communications and navigation stakeholders on vital issues concerning spectrum use.

Since its inception in 1989, Garmin has evolved as a leading, worldwide provider of certified aviation devices, almost all of which are enabled by Global Positioning System ("GPS") technology. Garmin's broad, overall product portfolio serves a wide variety of customers and brings critical safety-of-life applications to the global marketplace.

Garmin has long supported the development of new broadband services in this country; it believes, however, that broadband development generally should not come at the expense of harm to the nation's well-functioning, innovative, and economically important GPS service. With respect to the particular service put forward by Ligado, Garmin entered into a settlement agreement with Ligado in which Garmin agreed not to object to Ligado's proposals regarding Garmin's non-certified aviation and general

location/navigation lines of business as long as certain technical parameters were met.¹ At the same time, Garmin reserved the right to comment on issues related to certified aviation.² In addition, Garmin and Ligado did not reach an agreement about whether the 1 dB harmful interference criterion was an appropriate metric to use to evaluate interference, and Garmin continues to participate actively in discussions of the issue.³ Finally, the parties to the settlement agreed that Garmin's execution of the agreement did not constitute an endorsement by Garmin of Ligado's proposal.⁴

Garmin hereby files these comments within the bounds of its settlement agreement, in response to Ligado's June 5 and 22, 2017 *ex parte* filings with the FCC, to explain why Garmin believes a number of issues related to certified aviation devices still need to be resolved and why the 1 dB standard remains the appropriate metric for evaluation of interference to GPS devices.

I. Recent Submissions by Ligado Do Not Resolve Concerns Related to Certified Aviation Devices

In its most recent submissions, Ligado states that its "discussions with the FAA are now complete and have produced a detailed, workable approach to ensuring compliance with all applicable FAA standards and the protection of certified aviation GPS devices."⁵ The FAA, however, has yet to announce publicly any agreement with Ligado.⁶ While Garmin acknowledges Ligado's efforts to work with the FAA and its advisors to ensure that Ligado's operations protect certified aviation devices, Garmin notes that "discussion with the FAA" is not the same as an "agreement with the FAA" or public announcement by that agency of a resolution regarding the Ligado proposal – a resolution that would then be known to all stakeholders and could inform their actions.

The recent review by RTCA, Inc. ("RTCA") of the Ligado proposal showed significant unresolved issues that could adversely impact aviation safety. Garmin recognizes that Ligado participated in RTCA discussions to try to address some of the concerns raised by RTCA members; nevertheless, many of the concerns expressed in that forum remain unresolved. As a result, Garmin has serious concerns about the safety of certified aviation users whose devices may experience interference from Ligado operations in the 1526-1536 MHz band.

¹ See Paragraphs 9(a) and 10(a), "Settlement Agreement and Releases," by and between Garmin International, Inc. and New LightSquared LLC and LightSquared Subsidiary LLC dated Dec. 16, 2015, attached to Letter from Gerard J. Waldron to Marlene H. Dortch, IB Docket Nos. 12-340, *et al.*, Dec. 17, 2015 ("Settlement Agreement").

² *Id.* at Paragraphs 7(d) and 9(a).

³ *Id.* at Paragraph 6(h).

⁴ *Id.* at Paragraph 12.

⁵ Letter from Gerard J. Waldron to Marlene H. Dortch, IB Docket Nos. 11-109, *et al.*, June 5, 2017, unnumbered attachment at 11 ("Ligado June 5 Attachment").

⁶ "When asked what the FAA's position was with regard to Ligado, or if the agency had come to an agreement or understanding with the firm, a spokesperson for the U.S. Department of Transportation (DoT) said: 'There are no agreements between DoT (including FAA) and Ligado with respect to this effort.'" See Dee Ann Divis, "Opposition to Ligado Plan Expands," *Inside GNSS*, June 29, 2017, <http://www.insidegnss.com/node/5533>.

In fact, there are numerous issues with certified aviation devices that remain unaddressed with respect to Ligado's latest proposal:

- It is no longer clear whether Ligado, as it had proposed, will provide a public database of base station locations.⁷
- Helicopter operators remain concerned about their ability, when operating near Ligado's proposed standoff cylinders, to rely on GPS-based navigation and GPS-enabled capabilities for obstacle/terrain avoidance and position reporting with other airborne operators.⁸
- No proposal has been submitted for the provision of real-world operational test data.⁹
- GPS signal acquisition scenarios have not been analyzed.¹⁰
- There is no consensus on the assumptions for base station antenna height and inter-site distance that Ligado used to determine the aggregate RFI reduction."¹¹
- Parties do not agree about the requested review of Ligado base station EIRP.¹²
- Ligado disagrees with the aviation industry regarding the appropriate safety margin for aviation devices.¹³

Furthermore, notwithstanding Ligado's arguments to the contrary, recent tests by Roberson and Associates ("RAA"), the National Advanced Spectrum and Communications Test Network ("NASCTN"), and the US Department of Transportation ("DOT") fail to assuage Garmin's concerns regarding certified aviation devices. Ligado contends that "[a]ll three tests have vindicated the judgment of the GPS firms: devices in every category of the GPS ecosystem would not experience actual harm if Ligado were permitted to deploy a terrestrial network in accordance with the proposed parameters."¹⁴

While DOT is analyzing the impact of Ligado's proposed network on certified aviation devices and will include its findings in its forthcoming final report, the reports of RAA and NASCTN, which are already

⁷ Report of the Tactical Operations Committee in Response to Tasking from The Federal Aviation Administration, December 2016: *Operational Review of Ligado Networks Proposal for Standoff Cylinders*, at 6 https://www.rtca.org/sites/default/files/final_toc_ligado_proposal_review.pdf ("TOC Report"). Contrast Ligado June 5 Attachment at 28, which states: "Location data is submitted [to the FCC and FAA] confidentially because of competitive sensitivity. Access to the location data is governed by the FCC's standard rules regarding confidential data (e.g., access is available pursuant to a confidentiality order)."

⁸ Letter from Edward A. Yorkgitis, Jr. to Marlene H. Dortch, IB Docket Nos. 12-340, *et al.*, June 20, 2017 at 4-5 ("ASRI *Ex Parte* Letter"). Ligado's proposal states that it was based on "extensive consultations with ... one of the largest operators of helicopter emergency medical services." See Ligado June 5 Attachment at 25; however, there does not seem to be consensus within the helicopter industry. See Helicopter Association International concerns set forth in the TOC Report at 5.

⁹ See TOC report at 4-5. As noted there, Ligado has only submitted information on a model-based approach.

¹⁰ RTCA Paper No. 333-16/SC159-1055: "Summary of Ligado Proposal Review by RTCA SC-159, WG6, December 13, 2016," ("RTCA SC-159 WG6 Report") at 5, item 6 https://www.rtca.org/sites/default/files/sc-159_wg6_response_ligado.pdf.

¹¹ See RTCA SC-159 WG6 Report at 5, item 5.

¹² See *id.* at 6, item 7. WG6 has requested a review (either by RTCA or FAA) of the tools and results generated once the evaluation methodology is finalized. Ligado, on the other hand, proposes a post-deployment independent audit of the base station transmit EIRP limits "for the first two years." See Ligado June 5 Attachment at 28. According to Ligado, this audit would be performed by a "nationally recognized auditing and accounting firm. . . engaged at Ligado's expense." This is not the same as an audit by the FAA, which would likely be made in an independent manner and based on the greater experience and in-depth knowledge of the nation's expert aviation agency. It is also unclear when Ligado's proposed two-year period would start and how many Ligado base stations actually would be deployed at the time of the audit.

¹³ See RTCA SC-159 WG6 Report at 4, item 2.

¹⁴ Ligado June 5 Attachment at 1.

finalized, do not address this segment of the GNSS universe. In fact, RAA's testing did not include any certified aviation devices.¹⁵ Moreover, NASCTN readily acknowledged that "[d]evices specific to aviation, space-based, cellular, or military applications were outside of the scope" of its test.¹⁶ Consequently, it is inappropriate to suggest that these reports represent "devices in every category of the GPS ecosystem"¹⁷ or to draw conclusions about certified aviation devices from them. Thus, Garmin is concerned that Ligado's broad conclusions about these tests overlook significant concerns of the manufacturers and users of certified aviation devices.

In summary, Garmin does not represent that this letter includes an exhaustive list of every technical issue under discussion by RTCA or the FAA. Garmin's concern is that the Ligado *ex parte* filings imply that all known issues with the proposed Ligado network have been resolved with respect to certified aviation devices, when they have not.¹⁸ Garmin has commented in numerous FAA and RTCA proceedings over the years and intends to continue to submit its comments. Garmin participates to ensure adoption of critical standards, necessary for the safety of the aviation industry; it respects the FAA's jurisdiction and expertise regarding certified aviation issues and asserts that no authorization should be granted to Ligado until the FAA has explicitly and publicly acknowledged operation of the Ligado network as being compatible with certified aviation devices.

II. The 1 dB Standard Remains the Appropriate Metric for Evaluating Harmful Interference to GPS Receivers

Available record evidence and studies also do not support Ligado's recent contention that "[b]oth theoretical analyses and empirical testing have demonstrated that the '1 dB' metric is inaccurately and inconsistently measured; is arbitrary; and represents a flawed proxy because it does not translate to any noticeable impact on *actual* device performance."¹⁹

First, Garmin observes that this statement is inconsistent with the conclusions of the DOT, the parent agency of the FAA, which continues to support the 1 dB standard.²⁰ Second, it is also inconsistent with the position of the U.S. Air Force, which has recently published a technical paper defending the use of the 1 dB standard.²¹ Moreover, the Air Force has publicly reiterated its support for DOT's Adjacent Band

¹⁵ Letter from Gerard J. Waldron to Marlene H. Dortch, IB Docket Nos. 11-109, *et al.*, May 11, 2016, attached Roberson Test Report cover letter at 4 n.7.

¹⁶ NIST Technical Note 1952: "LTE Impacts on GPS: Final Report," ("NASCTN Report") at 3, <http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1952.pdf>.

¹⁷ See Ligado June 5 Attachment at 1.

¹⁸ For example, reliance on just one helicopter operator's position does not constitute resolution of the concerns of the entire helicopter community. Ligado claims that "helicopter operators . . . generally rely on visual cues—not GPS location data—when operating safely in close proximity to a tower." See Ligado June 5 Attachment at 26. However, helicopter operators indicate that "GPS reception is still critical for terrain avoidance and position reporting" and that "visual navigation is not always possible or reliable, especially at night and in bad weather." See ASRI *Ex Parte* Letter at 3.

¹⁹ See Ligado June 5 Attachment at 10 (*italics in original*).

²⁰ Presentation by Christopher Hegarty and Ali Odeh, The Mitre Corporation, DOT Workshop VI, "Loss of Lock Analysis" at 2, https://ntl.bts.gov/lib/61000/61200/61227/5-Loss_of_Lock_-_30Mar17.pdf.

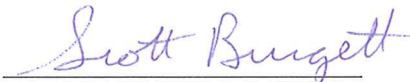
²¹ United States Air Force "BACKGROUND PAPER ON USE OF A 1-dB DECREASE IN C/N₀ AS GPS INTERFERENCE PROTECTION CRITERION," <http://www.gps.gov/spectrum/ABC/1dB-background-paper.pdf>.

Compatibility Assessment, and the 1 dB standard in particular.²² Finally, as the GPS Innovation Alliance has recently pointed out, the NASCTN data also support the 1 dB standard.²³

III. Conclusion

Garmin remains concerned about the potential effect of Ligado's proposed operations on the safe functioning of certified aviation devices and submits these comments to ensure the completeness and accuracy of the record. Garmin notes Ligado's general request that certified aviation devices be protected to the satisfaction of the FAA²⁴ and encourages the Commission to remain vigilant and engaged with the FAA to ensure that Ligado's proposed operation in the 1526 - 1536 MHz band does meet all FAA concerns and, once deployed, will not disrupt the safety and performance of certified aviation devices. Finally, Garmin encourages the Commission to uphold the 1 dB standard as the appropriate metric for evaluating harmful interference to GPS receivers.

Very truly yours,

By: 
Scott Burgett
Director, GNSS and Software Technology

²² "The Air Force is behind the international 1 decibel interference criteria standard and the testing that DoT is doing..." Statement by Maj. Gen. Catherine Chilton, "Opposition to Ligado Plan Expands," *supra* note 6.

²³ See Letter from F. Michael Swiek to Marlene H. Dortch, IB Docket Nos. 12-340, *et al.*, July 13, 2017.

²⁴ See Ligado June 5 Attachment at 7.